



Commonwealth of Massachusetts

Executive Office of Labor and Workforce Development

Department of Labor Standards

Executive Order #511

Trench Safety

Summary of Standards and Recommendations

This summary of standards was prepared by the Massachusetts Department of Labor Standards ("DLS") for informational purposes and does not constitute an official interpretation by OSHA or any other agencies/entities listed as a source of standards or guidance in this document, nor an exhaustive recitation of the requirements therein. Rather, the summary is provided for the health and safety committees to assess current health and safety management of this hazard against the nationally-recognized standard. As the information provided in this document is only a summary, please consult the full standard(s) as well as any other needed sources of technical assistance for developing or improving your trench safety program.

It is important to note that state workers are not covered by OSHA standards; the information generated by the health and safety committees will serve to guide the Massachusetts Employee Safety and Health Advisory Committee in identifying effective and practical strategies and policies for improving the health and safety of state workers.

Technical Standard or Guideline:

OSHA 29 CFR 1926 Subpart P – Excavations*
(includes 1926.650, 1926.651, 1926.652 and Appendices A - D)

Highlights of the Standard:

The standard defines a trench as: a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of the trench measured at the bottom is not greater than 15 feet. The standard further indicates that if a trench is made up of one soil wall and another vertical structure such as a foundation, and the distance between the two (measured at the trench bottom) is less than 15 feet, this also meets the definition.

Requirements of this standard only kick in if any employee(s) will go down into the trench.

Highlights of the OSHA standard include:

- Employees must be protected from cave-in of the soil walls in all trenches 5 feet or deeper, and also in shallower trenches where a cave-in hazard exists. This is

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- accomplished by use of trench boxes, shoring, or sloping back of the trench walls past the angle required by the standard.
- Ladders must be provided within 25 feet of unobstructed travel in all trenches 4 feet or deeper.
 - Inspections of trenches must be conducted by the “competent person” (outlined in the training section below) prior to the start of work and if there is a hazard-increasing event such as a rainstorm.
 - Underground utilities must be identified, and supported or removed if exposed.
 - In addition to protection from cave-ins, employees must be protected from other hazards associated with work in trenches including: vehicle traffic, falling loads, water hazards, mobile equipment, adjacent structures, loose rock or soil, and hazardous atmospheres.

The most significant hazard in a trench is cave-in of the soil walls. The key requirements of the standard specify equipment or methods to protect employees from cave-ins, such as trench boxes, shoring, or sloping back of the trench walls. Additional hazards that may be present at a trench work site are also included such as exposure to vehicle traffic and undermined adjacent structures.

** This is the primary national or state standard/guideline for this hazard. Your agency may be following an internal standard of practice or a standard from another source for this hazard. For the gap analysis, if you are following a standard other than the primary worker protection standard listed above, please indicate which standard, if any, is being followed by your agency. If this is an internal standard of practice, please report the basis upon which the determination was made to adopt the standard.*

Other Standards:

There is a Massachusetts Public Safety regulation to prevent trenches from being left open and unattended, known as “Jaclyn’s Law.”

520 CMR14.00 – Excavation and Trench Safety, available at www.mass.gov/dps, select “Trenches” from the left-side menu.

Jaclyn’s law outlines the requirements for protecting the public safety by disallowing open, unattended trenches. This standard comes into play once workers have left the trench worksite, therefore it is not relevant to the review of trench worker protections being conducted by the health and safety committees. The OSHA Excavation standard provides the requirements for protecting workers while inside of a trench, and this provides the basis for the health and safety committee assessment.

Upper Management Support / Policy:

A written trench safety policy based on the OSHA standard is recommended.

Training and Certification/Licensing Requirements:

Employees designated as *competent persons* (these are the staff tasked with conducting pre-work trench inspections per the OSHA standard) must have training, experience, and knowledge in the following areas:

- Requirements of the OSHA Excavation Standard.
- Use of protective systems (the equipment that protects employee from soil wall cave-ins, such as trench boxes or shoring)
- Soil analysis. The OSHA standard divides soil into 3 classifications Types A, B, and C. The soil type will dictate aspects of using soil protective systems, for example the depth to which a trench box can be used or the maximum spacing between shores. Type C soil is the least cohesive and presents the greatest cave-in risk. If you always assume you are working in Type C soil and follow the OSHA standard and equipment specifications accordingly, competent persons do not need to be proficient in soil analysis because you will be following the most protective measures.
- The ability to detect:
 - Conditions that could result in cave-ins.
 - Failures in protective systems.
 - Hazardous atmospheres.
 - Other hazards.

There is no specific requirement in the standard in terms of training hours or content for competent persons, instead the employer must provide whatever training is necessary so the employee becomes proficient in the areas listed above.

It is recommended that all other employees (not serving as competent persons) who will be working at trench worksites receive basic training in trench safety including trench hazards and use of protective systems. It is of particular importance that they also be trained in use of the actual trench safety equipment that they will be using at trench worksites (e.g., the specific brand and model owned by your agency).

Administrative Controls – Requirements:

Competent Person(s): must be designated by management, and provided with the necessary training as outlined in the training section above. Competent persons must also be given authority by management to take prompt corrective action, for example to remove employees from the trench when a hazard arises, or delay start of work until appropriate protective systems are in place. There must be enough competent persons to

cover multiple trench worksites if that occurs, and also to cover vacations and other absences.

Inspections: Inspections of every trench worksite must be made by a competent person prior to the start of work, and also when there is a hazard-increasing change in conditions such as rain.

Location of Underground Utilities: Prior to excavating, the location of underground utilities should be identified to the greatest extent possible, primarily through contacting DigSafe.

Spoils (excavated soil): The spoils must be kept back at least 2 feet from the edge of the trench. This is to prevent the spoils from sliding into the trench and engulfing workers, and also because the weight of the soil near the trench edge increases the forces on the excavated soil walls and increases the collapse hazard. Other “surface encumbrances,” such as heavy equipment, should also be kept back from the edge, again, as weight near the trench edge increases the collapse hazard.

Equipment and Engineering Controls – Requirements:

A **Protective System**, (e.g., trench box or shoring to protect against soil wall cave-in): is always required to protect employees working in trenches that are 5 feet deep or greater. A protective system is also required in trenches shallower than 5 feet if any cave-in hazard exists as determined by the competent person. The protective system does not need to be in place along the entire length of the trench, just the area surrounding where an employee is working.

There are two major types of protective systems:

- **Trench Shields** (trench boxes) consist of strong metal plates on at least two facing sides connected by spreaders, with the plates placed close to the trench walls. Trench boxes can be of fixed size, or a modular system that can be assembled to different sizes. They may also be circular in shape such as certain manhole shields. Trench shields are a passive system, they take the hit if the soil wall collapses, and the employees working inside the shield are protected. Trench shield requirements include:
 - The shield must be strong enough to withstand without failure the force that would be exerted by a soil wall collapse. This will be accomplished by ensuring that the trench shield is used in accordance with the engineer-stamped *manufacturer’s tabulated data* provided with the equipment, with the maximum allowable depth of use for the particular trench shield as the most important information.

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- The shield must be placed in the trench first, with the employees entering the shield only after it is in place.
 - For straight walls, the top of the shield must be at least as high as the top of the trench.
 - If any portion of the trench wall is sloped back, the trench shield must extend 18 inches above the top of the trench.
 - The distance between the trench wall and trench box plate should be kept to a minimum. Some manufacturers will specify a maximum allowable distance.
- **Shoring.** Shoring is an active system whereby pressure is applied against the trench walls to prevent cave-in. The most common type is aluminum hydraulic shoring which consists of a pair of aluminum upright struts connected by cross-braces that are pumped with hydraulic pressure. This braces the struts against the opposing trench walls. There are also systems with horizontal struts, called walers. Shoring requirements would include:
 - The shoring must be strong enough to withstand without failure the force that is exerted by the soil walls. This will be accomplished by ensuring that the trench shield is used in accordance with the engineer-stamped *manufacturer's tabulated data* provided with the equipment. For shoring the key information will be the maximum allowable spacing between the struts. This information is also provided in Appendix D of the OSHA standard, for example the maximum spacing between vertical struts in all soil types is 4 feet.
 - For vertical aluminum hydraulic shoring a protective system would consist of a minimum of two sets of struts/braces, with the employee working in between the two shores.
 - The shores must be placed in the trench first, with the employees entering the trench only after shores are in place.
 - In Type C soil, shores alone are not allowed, but must be used in conjunction with engineered plywood braced against the trench walls.
- **Engineer-Designed/Approved:** For work in any trench 20 feet in depth or greater, a Professional Engineer (PE) must design or evaluate and sign off on the specific protective system that will be used for that trench.

Sloping/Benching: In lieu of protective systems, the trench can be sloped back to the angle required by the OSHA standard. You are essentially cutting the trench walls back past the point where they would collapse on their own.

- For Type C soil, the walls must be sloped out 1 ½ feet for every foot of depth. If you are not trained in soil analysis, use this specification which is the most protective. Type C soil is what is most likely to be encountered in this area, in particular if the soil has been previously excavated. Any wet soil is automatically classified as Type C.

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- For Type B soil, the walls must be sloped out 1 foot for every foot of depth.
- For Type A soil, the walls must be sloped out $\frac{3}{4}$ foot for every foot of depth. Type A soil is not typically found in this area.
- Benching is simply sloping out the walls to the same angle, but instead of a straight line the wall is cut like a set of stairs. Type C soil is not cohesive enough to allow for benching.

Ladders:

- Ladders are required for all trenches 4 feet or greater in depth.
- Ladders must be available to workers in trenches within 25 feet of unobstructed travel.
- The ladder must extend 3 feet above the top of the trench to allow for safe entry and exit onto the ladder.

**Stability of Adjacent Structures / Sidewalks, Pavements, and Attached Structures /
/ Underground Utilities:**

- It is not allowable to undermine adjacent structures such as buildings without using *shoring, bracing, or underpinning* to provide temporary support during the excavation work.
- Roadways and sidewalk cannot be left undermined without a support system such as *bracing*.
- Exposed underground utilities must be supported for example through *bracing* from below or *strapping* from a horizontal member above. Utility pipes that are no longer supported by surrounding soil may not be able to hold up their own weight.

Traffic Control Devices: For work in trenches that will expose employees to vehicle traffic, all equipment and measures as outlined in the answers document for “Work Zone Safety” must be followed, including use of signs, cones, etc.

Personal Protective Equipment: Personal protective equipment should be selected based on any hazards present at the trench worksite. At a minimum, *hard hats* should be worn due to the overhead hazard. Protective eyewear, safety shoes, etc. should be used if the work conducted in the trench presents a risk to the eyes, feet, etc. If working in vehicle traffic, appropriate reflective clothing as outlined in the answers document for “Work Zone Safety” is required.

Air Monitoring for Hazardous Atmosphere: If there is any adjacent source of contaminants or other reason to believe that a hazardous atmosphere is present in the trench, air monitoring must be conducted with the equipment and procedures as outlined in the Confined Space answers document.

Emergency Response Planning:

Rescuing a worker from trench where the walls have collapsed is a highly dangerous and technically complex operation. Once a trench has collapsed, there is an extremely high chance of a second collapse, so rescue personnel cannot safely enter a trench without shoring up the walls or they risk becoming victims of the second collapse. Shoring up walls that are no longer straight and vertical because of the collapse is difficult and time-consuming. Most local fire departments in Massachusetts do not have the equipment and training to conduct this level of technical rescue. Therefore, fire personnel will have to risk their lives to save the trapped worker(s) or will not be able to conduct the rescue. If a worker is fully buried under the collapsed soil, the chance that they will survive is very negligible due to suffocation or crush syndrome.

Attempting the rescue on your own will most likely lead to additional victims due to a secondary collapse. Also, attempting to rescue a victim not visible under the soil with the backhoe more often than not leads to harming the victim with the machinery. Collapsing soil may engulf a worker on the spot, or the soil might move the victim across the entire trench, it is impossible to determine where the victim is located under the soil if they are not visible.

Having workers trapped by a trench collapse is COMPLETELY PREVENTABLE through the use of protective systems such as trench boxes or shoring. The best course of action is to never allow an employee to go into an unprotected trench, not for any reason, not for any length of time no matter how short.

Web link to full standard or guideline:

Informational resources identified below can also be found on our website at www.mass.gov/dols/eo511.

OSHA Standards:

www.osha.gov, select the “Regulations” tab from the top menu bar. For 1910 standards select the “General Industry” tab. For 1926 standards, select the “Construction” tab. Then, scroll down to find the standard by subpart and number.

OSHA 29 CFR 1926 Subpart P – Excavations
(includes 1926.650, 1926.651, 1926.652 and Appendices A - D)